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Performance Evaluation of Overflow Server under Different Arrival Rates in Mobile Network

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***Abstract*— This paper aims to reduce handover calls dropping as small as possible in mobile network and to improve the bandwidth utilization. This paper describes the blocking probability of each call in overflow models in case of changing of arrival rate new call, handoff call and SMS (short message service). The Equivalent Random Traffic (ERT) method is used for analytical results. To verify the accuracy of ERT approach, Monte Carlo Simulation is used. To verify the accuracy of ERT approach, Monte Carlo Simulation is satisfied to use. The application software has been developed by using C programming language.**

***Keywords*— Blocking Probability, New Call, Handoff Call, SMS and ERT.**

I. INTRODUCTION

This project aims to solve the problem of congestion in the case of mobile networks. The effect of admission control combinations is then analyzed, and the importance of some incoming traffic parameters is highlighted [1][3]. The problem for wireless networks is that the available radio frequency spectrum is limited, and can no longer support this increasing demand.

The role of a CAC scheme is to decide whether a call should be allowed to enter the system or not, by taking into account different QoS parameters. In mobile networks this decision is made more difficult by the existence of two types of call: new calls which wish to connect to the network and handoff calls that started in one cell and are willing to continue in another [2][5].

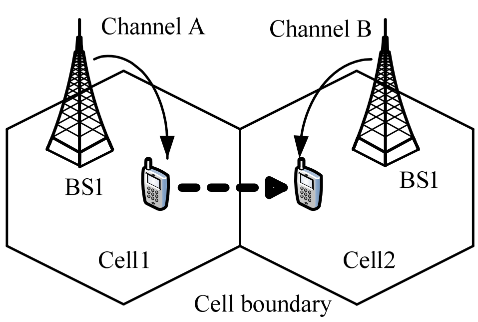

Fig. 1 Illustration of handoff occurence

In particular, in order to increase the system capacity, the cells sizes of the networks are reduced, and handover effect increased. Since users are more sensitive to handover dropping than to new call blocking, the channel assignment and handover priority is the important matter in cellular traffic planning.

Further Cellular network in host sport area of highly traffic demands will operate with many small cells, called microcells to increase capacity for services [3]. These small micro cells are covered with macrocell to serve overflow groups of channels for clusters of microcells as shown in Fig. 2.

One of the most accepted methods of dimensioning switches and trunks using alternative routing is the equivalent random Traffic (ERT) method. ERT has been successful tool for the analysis of overflow system. ERT method is known to accurately approximate the blocking probability for systems with Poisson arrivals and negative exponential holding times.

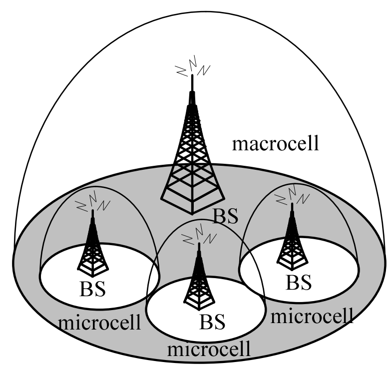

Fig. 2 A typical layered cellular network

II. FORMULAE FOR PROBABILITY

Equivalent Random Traffic (ERT) method plays a key role while dimensioning communication network. ERT method is also called Wilkinson-Bretschneider's equivalent method proposed by Wilkinson and Bretschneider [5] [6] [7].

Let us consider a group with L channels which is offered g traffic streams as shown in Fig. 3. From this figure, mean and variance of each traffic streams can be calculated. Let i'th traffic stream have its mean value $m_{1,i}$ and variance v_i. The total traffic stream to the group with C_s channels has the mean value given by:

$$m = \sum_{i=1}^{g} m_{1,i}$$

where, $m_{1,i}$ is mean value of i^{th} traffic stream (offered traffic)
m is mean value of total traffic.

If traffic streams are independent, the variance of total traffic stream was given by;

$$v = \sum_{i=1}^{g} v_i$$

where, v_i is variance of i^{th} traffic stream (offered traffic)
v is variance of total traffic.

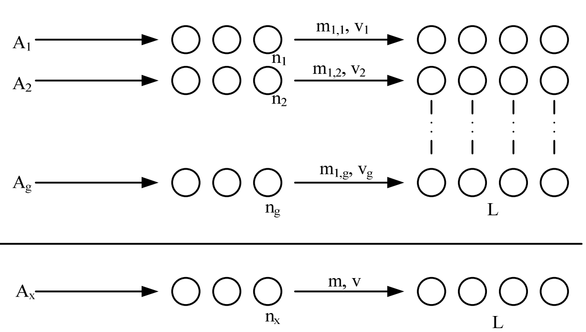

Fig. 3 Equivalent system with ERT method

III. PERFORMANCE MEASUREMENT

In this section, the blocking probability [16] will be generated by the following equations:

$$B_1 = \frac{\text{Number of blocking of new calls}}{\text{Number of offered traffic of new calls}}$$

where, B_1 = Blocking probability of new call

$$B_2 = \frac{\text{Number of blocking of handoff calls}}{\text{Number of offered traffic of handoff calls}}$$

where, B_2 = Blocking probability of handoff calls

$$B_3 = \frac{\text{Number of blocking of SMS}}{\text{Number of offered traffic of SMS}}$$

where, B_3 = Blocking probability of SMS

IV. PERFORMANCE OF OVERFLOW MODEL UNDER EACH DIFFERENT ARRIVAL RATES

The input parameters of this case are presented in Table I.

TABLE I
INPUT PARAMETERS

No.	Input Statements	Input Parameters
1	Mean departure rate for New calls	60s
2	Mean departure rate for Handoff calls	60s
3	Mean departure rate for SMS	60s
4	Mean inter arrival rate of New calls	0 to 3.6 calls/min
5	Mean inter arrival rate of Handoff calls	0 to 3.6 calls/min
6	Mean inter arrival rate of SMS	0 to 3.6 calls/min
7	The number of channels in voice only server	6 channels
8	The number of channels in data only server	4 channels
9	The number of channels in shared server	5 channels
10	Bandwidth usage for each type of call	1 channel/call
11	Total generated random numbers	1.0 E+10 2.0
12	Probability of no change	0.9
13	Total effected random numbers	2.0 E+09 to 3.0 E+09
14	Total no of arrivals calls	1.67 E+7 to 2.75 E +7
15	Total no Blocking calls	2.5 E +4 to 1.5 E +6
16	Total no of carried calls	1.5 E +7 to 2.7 E+7
17	Slot duration (t)	3s

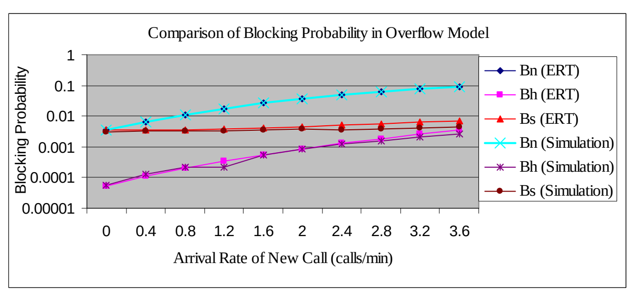

Fig. 4 Blocking probability of each call in overflow models in case of changing of arrival rate new call

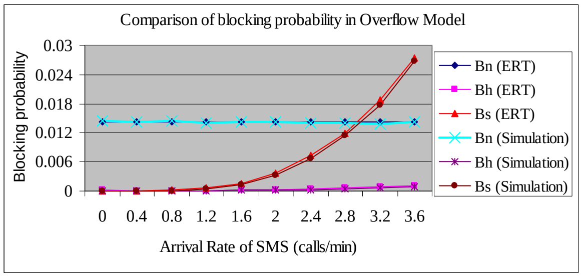

Fig. 5 Blocking probability of each call in overflow models in case of changing of arrival rate SMS

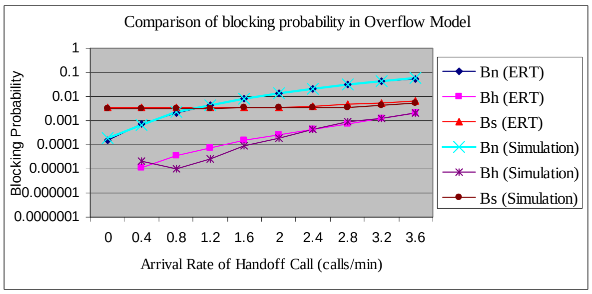

Fig. 6 Blocking probability of each call in overflow models in case of changing of arrival rate handoff call

Results shown in Fig. 4 to Fig. 6 are the blocking probability in overflow models (both analytical and simulation) under each different arrival rate. The results show that the blocking probability of new calls increase with increasing arrival rate of new calls and handoff calls but the blocking probability of SMS remain nearly constant. This is because SMS uses the channels in data only server and shared server. But new calls use the channels in local voice server, so the blocking probability of new calls remains constant under increasing arrival rate of SMS.

Increasing offered traffic of handoff calls effect small changes in the blocking probability of SMS shown in Fig. 5, but it has large effect on both new calls and handoff calls. Increasing arrival rate of SMS results significantly on its blocking probabilities but it effects small increase on blocking probability of handoff calls because of depending upon capacity of shared server. And so the bandwidth utilization are improved by using the overflow server.

V. CONCULSION

This research work has developed to study the performance evaluation of overflow cellular mobile telephones by using Equivalent Random Traffic (ERT) methods. In this research, simulation model is used to evaluate performance evaluation of the system for overflow models. This simulation model was constructed by Monte Carlo simulation methods. This method is a numerical method for generating random numbers to perform the simulation. Total blocking probabilities of the overflow calls decrease under large capacity of shared server.

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